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THE EFFECT OF NITROGEN FERTILIZER ON THE YIELD AND QUALITY IN THE SWEET MAIZE

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Abstract

The aim of the study was to determine the effect of nitrogen fertilizer application on fresh ear yield and quality properties in sweet maize in Isparta conditions during the years of 2012-2013. In this research, five different N doses (0, 50, 100, 150 and 200 kg ha^{-1}) were applied on the variety of Merit sweet corn. The study was carried out at Agricultural Research and Applied Center of Suleyman Demirel University in Turkey. This research was conducted in randomized block design with three replication. Plant height, first ear height, ear length, ear diameter, single fresh ear weight, fresh ear yield and crude protein ratio were determined. According to results of two years, nitrogen applications increased plant height, ear length, ear diameter, single fresh ear weight, fresh ear yield and crude protein ratio while first ear height was not affected by nitrogen doses. According to results of this research, 150 kg ha^{-1} nitrogen application is recommended for high fresh ear yield and quality in sweet maize in Isparta.

Key words*: sweet maize, nitrogen doses, ear characteristic, fresh ear yield, crude protein ratio.*

INTRODUCTION

Cereals are the main crops and occupied wide range of important parts of the world. Approximately 55% of protein, 15% of fats, 70% of glosides and generally 50 to 55% of calories consumed by humans in the world are provided by the cereals (Normohammadi et al., 2001). The economic importance of corn is clear as it has spread its planting in new world thousands of years ago; because all of its parts such as grain, branches and leaves, even corncob and corn silk is used numerously in human nutrition (20-25%), fed livestock and poultry (70-75%) and pharmaceutical industry (5%) (Mirhadi, 2001).

Sweet corn (*Zea mays* L. var. *saccharata*) is the same botanical species as common corn, the main difference being that the endosperm in the grains of fresh sweet corn have a greater polysaccharide content at commercial maturity. Sweet maize, which provides consumption, is especially important in food industry. In recent years, the production for fresh consumption and Conversion industries as two valuable careers are considered. Since the significant increase in crop production is achieved, the average yields of crops are yet less than their yield potential. The yield potential with full-product cultivars, under ideal management conditions and with optimal physical and also chemical environment will be achieved. Providing appropriate amount of fertilisation required for plant growth through appropriate distribution methods is one way to increase the crop yield (Fathi, 1999).

Nitrogen is one of the most prevalent elements and it is a component of amino acids, proteins, nucleic acids, chlorophyll and many other metabolites essential for survival of the plant. Nitrogen determine setting and maintenance of the photosynthetic potential of the plant reproductive capacity. Numerous field experiments conducted throughout the world has shown that nitrogen is the most important growth-limiting factor. Nitrogen application is one of the important nutrient amendments made to the soil to improve growth and yield of many crop plants (Reddy, 2006). Deficiencies of nitrogen profoundly influence the morphology and physiology of plants. Plants under low levels of nitrogen develop an elevated root: shoot ratio with shortened lateral branches. Higher levels of NO_3 inhibit root

growth and leads to a decrease in the root: shoot ratio (Scheible et al., 1997; Zhang et al., 1999).

Under nitrogen deficiency, plants exhibits stunted growth and small leaves. In the beginning of nitrogen deficiency, the older leaves show chlorosis when compared to younger leaves because of high mobility of nitrogen through phloem. Nitrogen deficiency induces the chloroplast disintegration and loss of chlorophyll. Necrosis occurs at later stages and if nitrogen deficiency continues, it ultimately results in plant death (Alimohammadi et al., 2011).

The objective of this research was to determine the effects of different rates of nitrogen fertilizers on fresh ear yield and quality properties of sweet corn.

MATERIALS AND METHODS

The study was carried out at Agricultural Research and Applied Center of Suleyman Demirel University (37°45′N, 30° 33′E, altitude 1035 m) located in Turkey, between 2012 and 2013 years.

The major soil characteristics, based on the method described by Rowell (1996) were as follows: the soil texture was clay-loam (clay: 31.2%, silt: 45.1%, sand: 23.7%); organic matter was 1.1% by the Walkley-Black method; total salt was 0.3%; lime was 7%; sulphur was 12 mg kg^{-1}; extractable P by 0.5 N $NaHCO_3$ extraction was 3.3 mg kg^{-1}; exchangeable K by 1 N NH_4OAc was 119 mg kg^{-1}; pH was 7.1 in soil saturation extract. Soil type was a calcareous fulvisol.

Sowing was done by hand on 15 May in 2012-2013. The experiments were evaluated in a randomized complete block design with three replications. Seeding row spacing 75 cm and distance within rows of 20 cm were used. Plot sizes were 3 x 5 m = 15 m^2. Sweet corn fertilized at the rates of 0, 50, 100, 150 and 200 kg N ha^{-1}.

Triple super phosphate (TSP 46%) and ammonium nitrate (AN 33%) were used as fertilizers. Crop was drip-irrigated. Crop management was similar to those commonly applied to commercial crops in the area.

Sampling to determine the parameters analysed was carried out in most treatments when the ears reached commercial quality and size, corresponding to 90 days after sowing.

Plant height, first ear height, ear length, ear diameter, single fresh ear weight, fresh ear yield and crude protein ratio were determined.

The data were analyzed together using the Proc GLM (SAS 1998). Means were separated by LSD at the 5% level of significance.

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Table 1. Results of Analysis of Variance Traits Determined

	df	Plant height	First ear height	Ear length	Ear diameter	Single fresh ear weight	Fresh ear yield	Crude protein ratio
Year	1	**	ns	ns	ns	*	ns	ns
Block	4	ns	ns	ns	ns	ns	ns	ns
Nitrogen	4	**	ns	**	**	**	**	**
Year*N	4	ns	ns	ns	ns	ns	ns	ns
Error	16							

**Significant at 1 percent level, *Significant at 5 percent level, ns: non significant.

RESULTS AND DISCUSSIONS

The results of variance analysis showed that plant height, first ear height, ear length, ear diameter, single fresh ear weight, fresh ear yield and crude protein ratio values in sweet maize were influenced significantly by nitrogen treatments (Table 1).

In present study, increasing N fertilization increased plant height value. The highest plant height were obtained from 100, 150 and 200 kg ha^{-1} N rates (177.5, 181.6 and 177.7 cm), while the lowest plant height (154.4 cm) was obtained from control plot (Table 2). These results are in agreement with those reported by

Grazia et al., 2003, Gözübenli, 2010 and Alimohammadi et al., 2011.

The effects of nitrogen fertilization on first ear height of sweet corn was found statistically not significant. The first ear height value from 60.5 to 70.2 cm as was determined. Contrary to this study, some researchers increased the first ear height by increasing the nitrogen dose (Koçak, 1991; Gözübenli, 1997; Turgut, 2000; Kara, 2006).

Other important quality characteristic for sweet maize is the size of ear. As the nitrogen dose increased, the increase in the ear length and ear diameter were also determined. The highest ear length (22.7 cm) and ear diameter (47.6 mm) were obtained from 150 kg ha^{-1} N rates, while the lowest ear length (15.8 cm) and ear diameter (39.6 mm) were obtained from control plot. Similar results were reported by other researchers (Turgut, 2000; Altıparmak, 2001; Grazia et al., 2003; Saruhan, Şireli, 2005; Kara, 2006; Gözübenli, 2010; Alimohammadi et al., 2011).

On account of single fresh ear weight, highest values were obtained from 100, 150 and 200 kg ha^{-1} N rates (272.9, 285.4 and 276.5 g), while the lowest value (151.9 g) was obtained from control treatment (Table 2). On the other hand, nitrogen fertilisation increased fresh ear yield relative to control. The highest fresh ear yield (26.03 t ha^{-1}) was obtained from 150 kg ha^{-1} N rate, while the lowest value (8.13 t ha^{-1}) was obtained from the control plot. The results are quite in line with those of Koçak, 1991 and Altıparmak, 2001.

Lower nitrogen fertilization decreased the grain weight because it affects the number of endospermic cells and starch granules in the early post flowering period, as well as reduces the source of assimilates during the filling period (Uhart, Andrade, 1995).

Crude protein content of forage is one of the most important criteria for forage quality evaluation (Holechek et al., 1989; Vogel et al., 1993). Increasing N fertilization rates resulted in an increase in CP ratio of sweet maize (Table 2). The highest CP ratio were obtained from 100, 150 and 200 kg ha^{-1} N rates (12.11, 12.88 and 12.31%), while the lowest CP ratio (10.04%) was obtained from control plot (Table 2).

Similar results were reported by Koçak (1991) and Altıparmak (2001).

Table 2. The plant height, first ear height, ear length, ear diameter, single fresh ear weight, fresh ear yield and crude protein ratio values of sweet maize at different nitrogen doses at the mean of two years

Nitrogen fertilization (kg ha^{-1})	Plant height (cm)	First ear height (cm)	Ear length (cm)	Ear diameter (mm)	Single fresh ear weight (g)	Fresh ear yield (t ha^{-1})	Crude protein ratio (%)
0	154.4 c	60.5	15.8 d	39.6 d	151.9 c	8.13 d	10.04 b
50	163.5 b	61.6	20.8 c	43.5 c	235.9 b	19.63 c	10.92 b
100	177.5 a	68.3	21.8 ab	45.0 bc	272.9 a	23.08 b	12.11 a
150	181.6 a	70.2	22.7 a	47.6 a	285.4 a	26.03 a	12.88 a
200	177.7 a	67.6	21.4 bc	47.1 ab	276.5 a	24.59 ab	12.31 a

CONCLUSIONS

As a consequence of nitrogen dose increased, the increase in the plant height, ear length, ear diameter, single fresh ear weight, fresh ear yield and crude protein ratio while first ear height was not affected.

According to results of this research, 150 kg ha^{-1} nitrogen application is recommended for high fresh ear yield and quality in sweet maize in Isparta.

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